Claims

1. A fiber laser comprising

a fiber (20) for generating laser light having an entrance side (18) and an exit side (22),

a pumped light source (10) for generating pumped light adapted to be coupled into the fiber (20) through the entrance side (18), and

resonator units provided at the entrance side (18) and/or at the exit side (22) of the fiber (20) for feeding the light, at least one wavelength range, exiting at the entrance and/or the exit side back into the fiber (20),

characterized in

that the entrance resonator unit and/or the exit resonator unit comprise at least one dielectric layer (16, 24) of variable optical thickness to set the at least one emission range.

2. The fiber laser of claim 1, wherein the entrance resonator unit and/or the exit resonator unit comprise a displaceable optical reflecting element (14, 26) to vary the optical thickness of the dielectric layer (16, 24).

3. The fiber laser of claim 2, wherein the optical reflecting element (14, 26) of the entrance resonator unit and/or the exit resonator unit is arranged at a variable distance from the entrance side (18) or the exit side (22), respectively.

4. The fiber laser of one of claims 1-3, wherein the entrance resonator unit and/or the exit resonator unit comprise a pressure variable gaseous medium to vary the optical thickness of the dielectric layer (16, 24).

5. The fiber laser of one of claims 1-4, wherein, in the entrance resonator unit and/or the exit resonator unit, the dielectric layer (16, 24) is arranged in a variable electric field to vary the optical thickness of the dielectric layer.

6. The fiber laser of one of claims 1-5, wherein the entrance resonator unit and/or the exit resonator unit are, for the laser light to be generated, highly reflective in the wavelength range with the least light amplification, especially having a reflection factor from 30% to 100%.

7. The fiber laser of one of claims 1-6, wherein the entrance resonator unit has a low reflection factor, especially below 50%, particularly preferred below 10%, for the wavelength range of the pumped light.

8. The fiber laser of one of claims 1-7, wherein, between the reflecting element (14) of the resonator unit and the entrance side (18) of the fiber (20) and/or between the reflective element (26) of the exit resonator unit and the exit side (22) of the fiber (20), a gap (16; 24) with a width of up to 20 μm, preferably less than 5 μm and particularly preferred less than 2 μm, is provided which is adjustable and controllable and through the width of which the wavelength of the light emission of the fiber laser may be determined.

9. The fiber laser of one of claims 1-8, wherein the gap (14) and/or (24) may be controlled such that laser light is generated simultaneously or individually in at least two wavelength ranges.

10. The fiber laser of one of claims 1-9, wherein the exit resonator unit comprises two mirrors, the first mirror (26) being highly reflective for the laser light to be generated in the wavelength range with the least light amplification, especially having a reflection factor from 30% - 100%, and the second mirror (38) is suitable for feeding light exiting at

the exit side (22), at least one wavelength range, back into the fiber (20).

11. The fiber laser of claim 10, wherein the second mirror (38) of the exit resonator unit is highly reflective at least for the other wavelength range for which the first mirror (26) of the exit resonator unit is substantially transparent so that laser light is generated in this other wavelength range.

12. The fiber laser of claim 10 or 11, wherein the exit resonator unit comprises an optical coupler unit (28) focusing the light exiting from the exit side (22) on the second resonator mirror (38).

13. The fiber laser of claim 12, wherein the optical coupler unit (28) is configured such that it serves to control the emission spectrum.

14. The fiber laser of claim 12 or 13, wherein the optical coupler unit (28) is an aspheric lens with chromatic aberration.

15. The fiber laser of one of claims 12-14, wherein the optical coupler unit (28) is adapted to be displaced for the control of the emission spectrum.

16. The fiber laser of one of claims 12-15, wherein the second mirror (38) of the exit resonator unit is adapted to be displaced for the control of the emission spectrum.

17. The fiber laser of one of claims 10-16, wherein the second mirror (38) of the exit resonator unit is connected with an entrance side (40) of a passive optical fiber (42).

18. The fiber laser of one of claims 1-17, wherein the exit resonator unit comprises only one mirror (38) which is preferably directly connected with the entrance side (40) of a passive optical fiber (42) and forms a

gap (24) with the exit side (22) that is up to 20 μm, preferably up to 3 μm, wide.

19. The fiber laser of one of claims 1-18, wherein the entrance side (18) and/or the exit side (22) of the active fiber (20) is coated with one or a plurality of dielectric layers (17, 23).

20. The fiber laser of one of claims 1-19, wherein the mirrors are multi-layered dielectric mirrors.

21. The fiber laser of one of claims 1-20, wherein single- and multi-layered dielectric systems are arranged at the entrance side (18) and/or the exit side (22).

22. The fiber laser of one of claims 1-21, wherein the displacement (30, 32, 34, 36) or the adjustment of an optical element and/or a plurality of optical elements, mirrors (14, 26, 28) and/or the input coupler unit (28) is effected piezo-electrically and/or electromagnetically and/or by means of a mechanical actuating means.

23. A method for operating a fiber laser of one of claims 1-22, wherein a regulating signal is generated from the intensity of the emission power, which adjusts and/or regulates the emission power of the fiber laser by driving the power of the pumping light source (10) and/or the position of one or a plurality of optical elements among the mirrors (14, 26, 38) and the input coupler unit (28).

24. The method of claim 23, wherein different regulating signals are generated from the intensity of the simultaneously emitted wavelength ranges.

25. The method of claim 24, wherein the different regulating signals are generated by a spatial and/or spectral separation and/or a separation of

the polarization signals and/or of the noise frequencies of the emitted wavelength ranges.

26. The method of one of claims 23-25, wherein different regulating signals are generated from the intensity of the emission power, which adjust and/or regulate the distribution of the emission power in different wavelength ranges of the fiber laser by driving the power of the pumping light source (10) and/or the position of one or a plurality of optical elements among the mirrors (14, 26, 38) and the input coupler unit (28).

27. The method of one of claims 23-26, wherein the light emission of the fiber laser in one or a plurality of wavelength ranges is coupled out from the entrance side (18) of the fiber using a suitable optical coupler unit (12).